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EXTRAIT

The Indo-European Phonological System: New Thoughts about its Reconstruction and Development.

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Abstract. — The Indo-European phonological system as traditionnally reconstructed must be regarded as extremely unlikely since that system is totally isolated typologically. Therefore, an alternate reconstruction, along the lines suggested by HOPPER and GAMKRELIDZE-IVANOV, is substituted for the traditional system. The ramifications caused by this substitution are discussed briefly, and the development of the system in the daughter languages is then traced.

1. *Introduction.*

In my article entitled " An Outline of the Historical Phonology of Indo-European ", I traced the development of the phonological system of the Indo-European parent language. I set up four periods of development : 1) the phonemic stress stage, 2) the phonemic pitch stage, 3) Late Indo-European, and 4) Disintegrating Indo-European. In the last section of that article, I summarized the development of the consonants in the Non-Anatolian daughter languages. The present article will deal with the development of the Indo-European phonological system in each daughter language in greater detail.

The attempted reconstruction of the phonological system of the Indo-European parent language has had a long history. The first steps were taken in the middle of the last century. Then, with each new generation of scholars, a series of brilliant discoveries were made in rapid succession. By the end of that century, the phonological system reconstructed by the Neogrammarians was widely accepted as being a fairly accurate representation of what had existed in Indo-European. Of course there remained problems, such as the question of the status of the interdental fricatives *þ* and *ð*, for example, but these problems did not affect the system as a whole.

The Indo-European phonological system as reconstructed by BRUGMANN (1904 :§37) sums up the views of this period :

Monophthongs :	a	e	o	i	u	ə			
	ā	ē	ō	ī	ū				
Diphthongs :	ai	ei	oi	əi	au	eu	ou	əu	
	āi	ēi	ōi		āu	ēu	ōu		
Syllabic Liquids and Nasals :				r̥	l̥	m̥	n̥	n̥̂	ŋ̥
				r̥̄	l̥̄	m̥̄	n̥̄	n̥̂	ŋ̥̄
Occlusives :	p	ph	b	bh	(labial)				
	t	th	d	dh	(dental)				
	k̂	k̂h	ĝ	ĝh	(palatal)				
	q	qh	g	gh	(velar)				
	q$^{\text{u̯}}$	q$^{\text{u̯}}$h	g$^{\text{u̯}}$	g$^{\text{u̯}}$h	(labiovelar)				
Fricatives :	s	sh	z	zh	þ	þh	ϑ	ϑh	
Nasals :	m	n	n̂	ŋ					
Liquids :	r	l							
Semivowels :	i̯	u̯							

The present century has seen the seeds planted by the young DE SAUSSURE blossom into the Laryngeal Theory, the reduction of the vowel system to a single member, and the removal of the voiceless aspirates. Furthermore, the diphthongs are no longer considered to have been phonemic, and the palatals are regarded as an innovation of the satem dialects.

The phonological system reconstructed by LEHMANN (1952 : §13.1) for Indo-European may be taken as representative of current views :

Obstruents :	p	t	k	k^{w}		
	b	d	g	g^{w}		
	b^{h}	d^{h}	g^{h}	g^{wh}		
		s				
Resonants :	m		n			
	w	r	l	y		
Vowels :		e	a	o	e	
	i·	e·	a·	o·	u·	
Laryngeals :			x	γ	h	ʔ

When typological comparisons were made between the resulting Indo-European phonological system and the phonological systems of living languages, it was recognized that the new system was not a natural one (cf. JAKOBSON 1971 : 528f. ; MARTINET 1970 : 115 ; SZEMERÉNYI 1967 : 65f.). This leads to the question of why the above changes were made in the first place if they resulted in the setting up of an unrealistic phonological system for Indo-European. The answer is simply that these changes were made on the basis of the discovery and analysis of new material that was unknown to the Neogrammarians. Moreover, a brief review of this material will show that most of the changes are fully warranted. But then, if these changes are warranted, how can we account for the fact that the resulting system is still unacceptable typologically? The answer here is that the original system reconstructed by the Neogrammarians was flawed to begin with and that the situation was only aggravated by making the above changes. The only solution to this problem is to modify the phonological system reconstructed for Indo-European to bring it into harmony with natural systems. However, when so modified, the then resulting system must not only be typologically acceptable but also historically probable, that is to say, it must be able to account for developments in the daughter languages at least as well as, if not better than, the old system.

Several attempts have already been made to correct the deficiencies of the Indo-European phonological system as traditionally reconstructed. In my opinion, however, only the revisions proposed by Gamkrelidze-Ivanov (1972 : 15f. and 1973 : 150f.) and, independently, by Hopper (1973 : 141f.) have successfully addressed the issues of typological plausibility and historical probability.

According to Hopper, the traditional voiced aspirates were really murmured stops, while the traditional plain voiced stops were really ejectives. Hopper's reinterpretation of the plain voiced stops as ejectives is based upon the observation that these sounds show many of the typological characteristics of ejectives. Gamkrelidze-Ivanov also reinterpret the traditional plain voiced stops as ejectives, but, unlike Hopper, they reinterpret the plain voiceless stops as voiceless aspirates. They make no changes to the traditional voiced aspirates. They point out, however, that the feature of aspiration is phonemically irrelevant.

Following Hopper and Gamkrelidze-Ivanov, the Indo-European phonological system as reconstructed by Lehmann should be revised as follows:

Obstruents:	p^h	t^h	k^h	k^{wh}			
	($p^{ʔ}$)	$t^{ʔ}$	$k^{ʔ}$	$k^{ʔw}$			
	b^h	d^h	g^h	g^{wh}			
		s					
Resonants:	m		n				
	w	r	l	y			
Vowels:	i	e	a	o	u		
	i·	e·	a·	o·	u·		
Laryngeals:				x	γ	h	ʔ

The task now is to explain how the phonological system of each daughter language developed from the Indo-European phonological system as revised by Hopper and Gamkrelidze-Ivanov. However, before doing this, it is necessary to discuss briefly the changes made in this century.

2. *The Laryngeal Theory.*

The Laryngeal Theory got its start in 1878 when DE SAUSSURE reinterpreted original long vowels as sequences of short vowels plus " coefficients sonantiques ". Even though DE SAUSSURE's theories were embraced and even improved upon by a few scholars, the overwhelming majority remained extremely skeptical. It was not until 1927, when KURYŁOWICZ demonstrated that one of DE SAUSSURE's " coefficients " was preserved in Hittite, that scholars began to take Laryngeal Theory seriously. For a detailed history of the Laryngeal Theory, cf. POLOMÉ 1965 : 9f. and SZEMERÉNYI 1973 : 1f.

It can no longer be seriously doubted that the Indo-European parent language possessed laryngeals ; the Hittite evidence is simply too compelling to be ignored. However, the number and nature of these laryngeals is still a matter of controversy. For example, BENVENISTE (1935 : 149) posits three laryngeals. He has continuously rejected attempts to define the laryngeals phonetically (1962 : 10). KURYŁOWICZ (1935 : 27f.), STURTEVANT (1942 : §8b and 1951 : 47f.), LEHMANN (1952 : §12.8), and KERNS-SCHWARTZ (1940 : 181f.) assume four laryngeals. STURTEVANT (1942 : §8b), following SAPIR, assigns the following phonetic values to the laryngeals : ' = a glottal stop with frontal timbre ; ? (in later works, STURTEVANT writes *h*) = a glottal stop with velar timbre ; *x* = a voiceless velar spirant ; *γ* = a voiced velar spirant. SZEMERÉNYI (1967 : 89f.) operates with only one laryngeal, the voiceless glottal fricative *h*. KEILLER (1970 : §4.4) reconstructs *h, ḥ,* ˤ. Finally, PUHVEL (1965 : 79f.) sets up a whole host of labialized and palatalized laryngeals.

According to KURYŁOWICZ (1935 : 27f.), ə̯$_1$ has no effect on vowel quality, while ə̯$_2$ and ə̯$_4$ change a contiguous *e* to *a*, and ə̯$_3$ changes a contiguous *e* to *o*. ə̯$_2$ and ə̯$_3$ are preserved in Hittite, but ə̯$_1$ and ə̯$_4$ are lost. Original long vowels develop from the contraction of a short vowel and a following laryngeal. Sequences of plain voiceless stop plus laryngeal develop into voiceless aspirates in Indo-Iranian. Finally, KURYŁOWICZ claims that words beginning with initial vowels in Indo-European have lost a preceding laryngeal.

Unlike KURYŁOWICZ and SAPIR, STURTEVANT (1942 : §9b) rejects the theory that *γ* (KURYŁOWICZ's ə̯$_3$) changes a contiguous *e* to *o*. Furthermore, STURTEVANT (1942 : §9a) reconstructs laryngeals only for Indo-Hittite and not for its Indo-European descendant.

My own views are closest to those of STURTEVANT. I believe that the Indo-European antecendent of the Anatolian languages contained four laryngeals (cf. 1976 : §12.1 and §12.10) : *ʔ, h, x, γ*. Four laryngeals are needed here to account for cases of 1) *e* without an accompanying Anatolian laryngeal reflex, 2) *e* with an accompanying Anatolian laryngeal reflex, 3) *a* without an accompanying Anatolian laryngeal reflex, and 4) *a* with an accompanying Anatolian laryngeal reflex. However, for the Indo-European antecedent of the Non-Anatolian daughter languages, no more than one laryngeal is needed. **Szemerényi** (1967 : 67f.) is certainly correct in reconstructing a full complement of long and short vowels for this form of Indo-European. Therefore, the vowel-coloring and vowel-lengthening effects usually ascribed to the laryngeals must have taken place at some point between the separation of Proto-Anatolian from the main speech community and the emergence of the Non-Anatolian dialect groups.

Due to the fact that the laryngeals have had such a marked effect on the vowel system, it is impossible to discuss them without also discussing the vowels. In the next section, the development of vowel gradation will be summarized. The modifications to the vowel system caused by the laryngeals will be mentioned there as well as the probable timing of the loss of laryngeals.

3. *The Vowels and Vowel Gradation.*

The vowel system of the Indo-European antecedent of the Non-Anatolian daughter languages may be reconstructed as follows (cf. **Meillet** 1964 : 98f. ; **Szemerényi** 1970 : 31f.) :

e	o	a	i	u
ē	ō	ā	ī	ū

Another vowel must also be reconstructed, the so-called " schwa primum " (cf. **Szemerényi** 1970 : 34). This vowel, which represents a vocalized laryngeal (cf. **Bomhard** 1975 : §6.7 and 1976 : §12.13), appears as ε, ο, or α in Greek and as *i* in Indo-Iranian, while elsewhere it develops along the same lines as IE *a*. The Greek developments are probably secondary (cf. **Szemerényi** 1972 : 125f.).

This form of Indo-European was characterized by an interchange of vocalic elements (vowel gradation) that could occur in any syllable. This interchange, which was partially correlated with the position of the accent and with distinctions between morphological categories, could be qualitative, quantitative, or both combined. It is usually assumed that *e/ē* ~ *o/ō* ~ *zero* were in contrast and that the vowel *a* played no role in this system. However, by denying the existence of *a*, the problem of typological improbability arises. The fact is that the vowel *a* must be reconstructed as an independent phoneme not only for this form of Indo-European but also for every other form of Indo-European (cf. **Bomhard** 1976 : §7.4 ; **Szemerényi** 1964 : 2f. and 1967 : 67f.).

Correspondences:

Late Indo-European	e	o	a	ē	ō	ā
Gothic	i	a		ē	ō	
Old Irish	e	o	a	í	á	
Latin	e	o	a	ē	ō	ā
Greek	ε	ο	α	η	ω	ᾱ
Tocharian B	ya- ä a	e	ā a	ye- e	ā a o	ā a
Indo-Iranian	a			ā		
Albanian	je i e	a ë		o	e	o
Armenian	e	o	a	i	u	a
Old Ch. Sl.	e	o		ě	a	
Lithuanian	e	a		ė	uo ō	ō

Late Indo-European	i	u	ī	ū
Gothic	i ai	u au	ei	ū
Old Irish	i	u o	í	ú
Latin	i	u	ī	ū
Greek	ι	υ	ῑ	ῡ
Tocharian B	i	u o	i	u o
Indo-Iranian	i	u	ī	ū
Albanian	i	u	i	y
Armenian	i	u	i	u
Old Ch. Sl.	ĭ	ŭ	i	y
Lithuanian	i	u	y	ū

It may be assumed that Pre-Indo-European had the following vowels (cf. Bomhard 1975: §2.1 and 1977: §27):

a i u
ā ī ū

The earliest period of Indo-European proper that can be reconstructed was characterized by a strong stress accent (cf. Bomhard 1975: §3.4; Burrow 1973: 108f.; Lehmann 1952: §15.4). This accent caused the elimination of unaccented vowels. There was a contrast between those syllables with stress and those syllables without stress. Stress was used as an internal grammatical morpheme, the stressed syllable being the morphologically distinctive syllable. This is the stage of development that I have called " Stress Indo-European ". It was probably during this period that the syllabic nasals and liquids came into being (cf. Bomhard 1975: §3.8).

The system of accentuation based upon the contrast between stress and lack of stress became disrupted when the vowels of morphologically nondistinctive sylllables were either retained or, if they had previously been lost, restored in certain of these nondistinctive syllables. High pitch then replaced stress as the suprasegmental indicator of morphologically important syllables (cf. Burrow 1973 : 112f. ; Lehmann 1952 : §15.3). There was a contrast between morphologically distinctive syllables with full-grade vowel and high pitch and morphologically nondistinctive syllables with full-grade vowel and low pitch. Under high pitch, *a* and *ā* had front allophones, and, under low pitch, they had back allophones (cf. Bomhard 1975 : §4.4, 1976 : §7.3, and 1977 : §24). This stage of development may be called " Pitch Indo-European ". It was at the end of this stage that the Anatolian languages became separated from the main speech community (cf. Bomhard 1975 : §4.5 and 1976).

In the next stage, " Late Indo-European ", pitch distribution underwent a morphologically-conditioned rearrangement. The allophones of *a* and *ā* then became partially disassociated from pitch distribution, and *e*/*ē* and *o*/*ō* became phonemic (cf. Bomhard 1975 : §5.4 and 1976 : §7.3) except that *á* was not changed to *e* in the neighborhood of the laryngeals *h* and *x* (cf. Bomhard 1975 : §5.5). This is a reformulation of the theory that maintains that these laryngeals changed a contiguous *e* to *a*. This reformulation was first suggested by Warren Cowgill in a paper read before the Linguistic Society of America in 1968. The vowel system of Late Indo-European was thus as follows :

e o a i u
ē ō ā ī ū

In " Disintegrating Indo-European ", laryngeals were lost 1) initially before vowels (except for *x*, cf. Bomhard 1976 : §12.13) and 2) after vowels when a nonsyllabic followed. This latter change caused compensatory lengthening of preceding short vowels (cf. Bomhard 1975 : §6.4 ; Kuryłowicz 1935 : 28 ; Lehmann 1952 : §3.6B ; Sturtevant 1942 : 66f.) :

HeC- 〉 eC- -eHC- 〉 -ēC-
HoC- 〉 oC- -oHC- 〉 -ōC-
Hac- 〉 aC- -aHC- 〉 -āC-
HiC- 〉 iC- -iHC- 〉 -īC-
HuC- 〉 uC- -uHC- 〉 -ūC-

Laryngeals must have remained in other positions. This is the only way to account for developments in the Non-Anatolian daughter languages such as the voiceless aspirates in Indo-Iranian, the Greek prothetic vowels, the Balto-Slavic intonations, etc. (cf. Bomhard 1976 : §12.13 ; Lehmann 1952 : §12.1). It should be noted that, on the basis of the Armenian evidence, I assume that the laryngeal *x* was not lost initially before vowels (cf. Bomhard 1976 : §12.11-§12.13), at least in Pre-Proto-Armenian.

Finally, I assume that the laryngeals merged into *h* in Disintegrating Indo-European and that this single laryngeal could have a vocalic allophone, the traditional schwa primum (cf. BOMHARD 1975 : §6.7 and 1976 : §12.13). As far as I can see, there is no evidence to support the assumption of a " schwa secundum " (cf. SZEMERÉNYI 1970 : 34). Since the schwa primum is clearly in alternation with original long vowels and since these original long vowels are to be derived from earlier sequences of short vowel plus laryngeal, the only logical conclusion is that the schwa primum is a vocalized laryngeal.

4. *The Voiceless Aspirates.*

The evidence for the existence of voiceless aspirates in Indo-European is extremely slight, coming almost exclusively from Indo-Iranian. This fact has led a number of scholars to deny the phonemic status of these sounds in Indo-European and to suggest that their occurrence in the daughter languages is due to secondary developments (cf. ALLEN 1976 : 237f. ; BURROW 1973 : 71f. ; KURYŁOWICZ 1935 : 46f. ; LEHMANN 1952 : 80f. ; POLOMÉ 1971 : 233f. ; STURTEVANT 1942 : 83f.).

The first to suggest that the voiceless aspirates were secondary was DE SAUSSURE. In a paper read before the Société de Linguistique de Paris in 1891, he derived these sounds from sequences of plain voiceless stop plus a following " coefficient ". A laryngeal explanation, along the lines proposed by DE SAUSSURE, has much to recommend it in many cases. For example, the voiceless aspirate found in Skt. *tíṣṭhati* " stands " can plausibly be derived from an earlier sequence of plain voiceless stop plus laryngeal, that is **(s)ti-stH-e-ti.* This explanation is supported by the corresponding Greek form ἵστημι (〈 **si-staH-mi*) " I place ", with long vowel from earlier short vowel plus following preconsonantal laryngeal. Sanskrit has zero-grade of the root, and Greek has full-grade. Av. nom. sg. *pantā̊* " path, way " is from **péntaH-s*, while the gen. sg. *paθō* (cf. Skt. gen. sg. *patháḥ*) is from **pn̥tHós.* The voiceless aspirate found in the Skt. nom. sg. *pánthāḥ* is from the weak cases. For other examples, cf. BURROW 1973 : 71f., KURYŁOWICZ 1935 : 46f., and STURTEVANT 1942 : 83f.

While DE SAUSSURE's theory accounts for the origin of some cases of voiceless aspirates, it does not explain all. There are several words of onomatopoeic origin that contain voiceless aspirates. Among these are 1) Skt. *kákhati* " laughs ", Arm. *xaxank*^{h} " guffaw ", Gk. καχάζω " I laugh ", OCS. *xoxotŭ* " guffaw ", Lat. *cachinnō* " I laugh aloud ", and 2) Skt. *phū̆t-karoti* " puffs, blows ", Arm. *p*^{h}*uk*^{h} " breath, puff ", Gk. φῦσα (〈 *φῦτι̯α) " a pair of bellows ", Lith. *pū̃sti* " to blow (air) ". A laryngeal explanation is to be ruled out here.

Finally, some voiceless aspirates in Indo-Aryan seem to owe their origin to the " spontaneous aspiration " of the plain voiceless stops after a preceding *s* (cf. **Burrow** 1973 : 72 and 393 ; **Polomé** 1971 : 239f.). A good example is Skt. *sthagati* " to cover, hide, conceal " beside Gk. στέγω " to cover ".

The voiceless aspirates were thus not phonemic in Indo-European and did not become so in the majority of the daughter languages. The voiceless aspirates found in the onomatopoeic words mentioned above are probably the only ones that should be assigned to Indo-European and are to be regarded here simply as nonphonemic allophones of the plain voiceless stops.

Correspondences :

IE	Skt.	Av.	Arm.	Gk.	OCS.	Goth.	OIr.	Lat.	Lith.	Toch.
p	p ph	p f	h w Ø p^h	π φ	p	f b	Ø	p	p	p
t	t th	t θ	t^h	τ	t	þ d	t th	t	t	t c ts
k	ś k c kh	s k č x	s k^h x	κ χ	s k č c x	h g	c ch	c	š k	k ç

5. *The Gutturals.*

Late Indo-European may be assumed to have had two types of gutturals : velars and labiovelars. The latter type was characterized by a secondary articulation of labialization that served to maximize the distinction between this series and the plain velars.

It has often been assumed that Indo-European had three guttural series : 1) palatals, 2) velars, and 3) labiovelars. This theory, however, is without foundation. In the first place, such a theory would force us to assume that there was a common innovation in the Indo-European antecedent of the centum languages in which the palatals merged with the velars. There is absolutely no evidence whatsoever that such a merger has taken place. Furthermore, the palatals can be shown to have become phonemic only in the Indo-European antecedent of the satem languages (cf. **Lehmann** 1952 : §2.1b ; **Meillet** 1964 : 94f.). Finally, it is not necessary to set up a third series to account for cases in which velars in the satem languages correspond to velars in the centum languages since these can be explained equally well by assuming just two series (cf. Burrow 1973 : 76f.).

Palatalization of velars is an extremely common phenomenon and can be observed in the historical development of many languages. We can take the developments in the Romance languages as an example. Classical Latin had the following gutturals (cf. Sturtevant 1940 : 165f.) :

Velars	c, k	/k/	g	/g/
Labiovelars	qu	/kʷ/	gu	/gʷ/

Somewhere around the beginning of the third century A.D., /k/ and /g/ were palatalized to /kj/ and /gj/ respectively before *e, ae, ē, i,* and *ī* (cf. Elcock 1960 : 53f.). /kj/ and /gj/ then became /tj/ and /dj/ respectively and then /tsj/ and /dzj/. /tsj/ developed into Fr. /s/, Sp. /θ/, Port. /s/, It. /tš/, and Rom. /tš/. It should be noted that Sardinian is a relic area in which /k/ is not palatalized. /dzj/ developed into Fr. /ž/, Sp. /j/, Port. /ž/, It. /dž/, and Rom. /dž/.

There has also been a general delabialization of /kʷ/ and /gʷ/ in the Romance languages, especially before front vowels. For details about the development of the gutturals in the Romance languages, cf Mendeloff 1969 : 16f.

Returning now to Indo-European, the comparative evidence allows us to reconstruct the following gutturals for Late Indo-European :

Velars	k	kˀ	g
Labiovelars	kʷ	kˀʷ	gʷ

The Anatolian data are particularly important here. The Anatolian languages show no trace of either palatalization of the velars or of delabialization of the labiovelars(cf. Bomhard 1976 : §§10.7-10.12 and Sturtevant 1951 : 55f. for examples). Therefore, we can say with some assurance that Pre-Anatolian Indo-European had only two guttural series and that the development of palatal allophones of the velars and the delabialization of the labiovelars must have taken place after the separation of the Anatolian languages from the main speech community.

There are many important parallels between the Romance developments described above and the Indo-European developments. As in Proto-Romance, Post-Anatolian Indo-European developed palatalized allophones of the velars. Palatalized allophones came into being when the velars were contiguous with front vowels and with apophonic *o* (cf. Georgiev 1966 : 21f.). These palatalized allophones became phonemic when the labiovelars were delabialized in the Indo-European antecedent of the satem languages. The unpalatalized velars and the delabialized labiovelars then merged. Again, similar developments may be observed in the Romance languages. Since the labiovelars did not become delabialized in the

Indo-European antecedents of the centum languages, there was no impetus for the phonemicization of the palatals here. These developments may be represented diagrammatically thus:

Step 1. Velars develop nonphonemic palatalized allophones when contiguous with front vowels:

Contiguous with Front Vowels		Contiguous with Back Vowels	
k	/c/	k	/k/
kˀ	/cˀ/	kˀ	/kˀ/
g	/ɟ/	g	/g/

Step 2. In the Indo-European antecedent of the satem languages, the labiovelars are delabialized and merge with the unpalatalized velars:

kʷ > k
kˀʷ > kˀ
gʷ > g

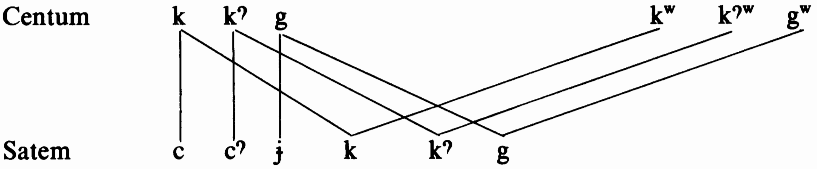
Step 3. Both palatalized and unpalatalized velars are now found in the vicinity of front vowels.
This contrast becomes phonemic:

Contiguous with Front Vowels			Contiguous with Back Vowels		
k	/c/	> c			
kˀ	/cˀ/	> cˀ			
g	/ɟ/	> ɟ			
k	(< kʷ)	> k	k	(< k, kʷ)	> k
kˀ	(< kˀʷ)	> kˀ	kˀ	(< kˀ, kˀʷ)	> kˀ
g	(< gʷ)	> g	g	(< g, gʷ)	> g

Step 4. Palatals are analogously extended to the vicinity of back vowels.

Even though the Guttural Theory just outlined above cannot explain every example, it has, nevertheless, the advantage of being able to account for the greatest number of developments. Moreover, it is fully compatible with everything we know about sound change and has historically attested parallels in natural languages. Cf. Meillet 1964: 91f. and 1967: 68f. for essentially the same conclusions about the development of the gutturals.

Correspondences :



Sanskrit	ś	j	h	k c	g j	gh h	k c	g j	gh h
Avestan	s	z		k x č š	g γ ǰ ž		k x č š	g γ ǰ ž	
Albanian	s th	z dh d		k q	g gj		k q	g gj	
Armenian	s	c	j z	k^h	k	g ǰ ž	k^h	k	g ǰ ž
Old Ch. Sl.	s	z		k č c	g ž dz		k č c	g ž dz	
Lithuanian	š	ž		k	g		k	g	

Gothic	h g	k	g	h g	k	g	hw h	q k	w
Old Irish	cch	g		c ch	g		c ch	b g	g
Oscan	c k	g	h	c k	g	h	p	b	f
Latin	c	g	h g f	c	g	h g f	qu c	v gu g	f v gu
Greek	κ	γ	χ	κ	γ	χ	π τ κ	β δ γ	φ θ χ
Tocharian	k ç			k ç				ku k ç	

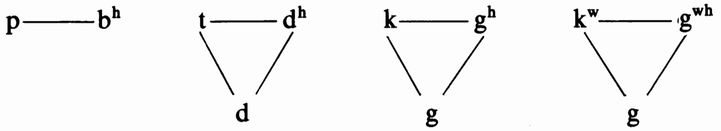
6. *The Glotttalized Stops.*

Correspondences :

Late Indo-European	$t^{ʔ}$	$k^{ʔ}$	$k^{ʔw}$
Sanskrit	d	j	g j
Avestan	d	z	g γ ǰ ž
Albanian	d dh	z dh d	g gj
Armenian	t	c	k
Old Ch. Sl.	d	z	g ž dz
Lithuanian	d	ž	g
Gothic	t	k	q k
Old Irish	d	g	b g
Oscan	d	g	b
Latin	d	g	v gu g
Greek	δ	γ	β δ γ
Tocharian	t c ts	k ç	ku k ç

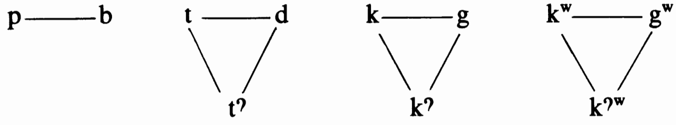
It is a well-known fact that the phoneme traditionally reconstructed as *b* was so rare as to be virtually nonexistant in the Indo-European parent language (cf. Gamkrelidze 1976 : 403 ; Hopper 1973 : §3.2.3 ; Lehmann 1952 : §15.1 ; Meillet 1964 : 84 and 89). Such a gap is difficult to understand and is totally unexplainable within the traditional framework.

The majority of scholars currently agree that the voiceless aspirates were not phonemic in Indo-European (cf. §4) and that Indo-European had a stop system with a three-way contrast (except in the labial series) :



Such a system is typologically unacceptable, however, since no known natural language has such a contrast (cf. Jakobson 1971 : 528 ; Martinet 1970 : 115). Therefore, we must either reinstate the voiceless aspirates as Szemerényi (1967 : 88f.) has attempted to do or come up with a truly new look for Indo-European. Now, since there are extremely cogent arguments against reinstating the voiceless aspirates (cf. §4 for details and references), the only course open is to seek a typologically acceptable alternate reconstruction for the Indo-European stop system.

A reinterpretation of the traditional plain voiced stops as glottalized stops (ejectives) solves both of the above problems. In the first place, it is common for languages with ejectives to have a gap in the labial series (cf. Greenberg 1970 : 127 ; Hopper 1973 : §3.2.3). Next, the positing of ejectives in place of the traditional plain voiced stops leaves the traditional voiced aspirates as the only ones with voicing. With the reinterpretation of the traditional voiced aspirates as either murmured stops (cf. Hopper 1973 : §3.1.1) or as plain voiced stops (cf. Bomhard 1975 : §3.9), the new system becomes complete :



The resulting system belongs to a quite common type. Similar systems can be found, for example, in the Caucasian languages, Coos, Haida, Mayan Chontal, Puget Sound Salish, Walamo, Washo, and Yapese, to name just a few (cf. Ruhlen 1976). The new system, therefore, fulfills the requirement of typological acceptability. The question now is whether or not the new system can also fulfill the requirement of historical probability.

There is no uniform treatment of the glottalics. The Germanic, Armenian, Tocharian, and Anatolian developments are straightforward : deglottalization. In the other daughter languages, the glottalics have developed into plain voiced stops. No doubt, the development went as follows : glottalized → creaky voice → full voice. Such a progression is perfectly natural and has parallels in several of the Caucasian languages (cf. Colarusso 1975 : 82f. ; Gamkrelidze-Ivanov 1973 : 154). In the Modern South Arabian languages, " the post-glottalized (ejective) consonants have partially voiced and more rarely wholly voiced variants " (cf. Johnstone 1975 : §2.1.2).

The development of the glottalics into voiced stops in Indo-Iranian, Baltic, Slavic, Albanian, Italic, Celtic, and Greek must have taken place in the early history of these branches themselves and not in the parent language. That is to say that we are dealing here with parallel developments and not a common innovation. This is proved by the fact that the glottalics were treated differently in each daughter language once they had been changed into voiced stops. In Albanian, Baltic, Slavic, and Iranian, the glottalics merged completely with the murmured stops (the traditional voiced aspirates). In Old Indic, the glottalics became plain voiced stops but did not merge with the murmured stops. In Italic and Greek, the change of glottalics into voiced stops could only have taken place after the murmured stops had become voiceless aspirates (cf. Hopper 1973 : §3.3.2) since the two series are kept completely separate. The change of murmured stops into voiceless aspirates is not without parallels ; one can cite the example of Romany (cf. Meillet 1967 : 100).

It is thus clear that the positing of glottalics in place of the traditional plain voiced stops also fulfills the requirement of historical probability. Furthermore, several problems that could not be accounted for within the traditional framework now become explainable.

The Indo-European stem for the verb " to drink, swallow " is traditionally reconstructed as **peə̯ʒ-* (Kuryłowicz) or **peγ-* Lehmann, Sturtevant), with a voiced laryngeal. It is this voiced laryngeal that is supposed to voice the contiguous *p* to *b* in Skt. *píbati* " drinks ", Lat. *bibit*, OIr. *ibid*, as if from earlier **pi-pγ-eti* (cf. Burrow 1973 : 72f.). However, *γ* normally yields *ḫ* in Hittite (cf. Bomhard 1976 : §§12.7-12.9 and Sturtevant 1951 : §75 for examples), and the Hittite derivative of this stem, *pašzi* " drinks, swallows ", lacks a laryngeal reflex. It is, therefore, extremely unlikely that the Indo-European form contained *γ*. A reconstruction **poˀ-* solves all problems associated with this stem. First, such a reconstruction accounts for the lack of a laryngeal reflex in Hittite since ˀ is normally lost there (cf. Bomhard 1976 : §12.10 ; Sturtevant 1951 : §77). Next, the voicing of *p* to *b* in Sanskrit, Latin, and Old Irish is easily explained since this would be the normal development for a glottalized stop in these languages. Thus, instead of **pi-pγ-eti*, we should reconstruct **pi-pˀ-eti*.

Indo-European had constraints on permissible root structure sequences (cf. LEHMANN 1952 : §2.3e ; MEILLET 1964 : 173f.). Under the traditional system, these constraints seem strangely capricious. Under the new system, however, they become completely natural, with several typological parallels (HOPPER 1973 : §3.2.6 cites the examples of Hausa, Yucatec Mayan, and Quechua). HOPPER (1973 : §3.2.6) has restated the constraint laws thus :

1. Each root contains at least one [−checked] obstruent ;
2. When both obstruents are [−checked], they must agree in voicing.

Only the glottalics are [+checked]. They are also neutral as to voicing. For additional information on the Indo-European root structure constraints, cf. GAMKRELIDZE 1976 : 404f.

Under the traditional system, the Germanic and Armenian " sound shifts " are anomalous. Nothing quite the same exists in any of the other daughter languages (except probably the poorly attested Thracian and Phrygian). There is, of course, Tocharian, but the changes there are different in that the opposition between the traditional plain voiceless, plain voiced, and voiced aspirated stops is completely eliminated (cf. VAN WINDEKENS 1976 : §223), while in Germanic and Armenian, the opposition remains intact. The Germanic and Armenian developments cannot have been due to a common innovation since there is no indication that these two branches were ever in contact. Under the new system, these branches are to be seen as relic areas. In fact, they provide a key piece of evidence in support of the Glottalic Theory.

The Glottalic Theory stands out as the single most important contribution to the reconstruction of the Indo-European phonological system made during this century. The only possible competitor, the Laryngeal Theory, had its origins in the closing decades of the last century.

7. *The Murmured Stops.*

HOPPER (1973 : §3.1.2) classifies the traditional voiced aspirates as murmured stops. He does so to account for the Indo-Aryan, Greek, and Latin reflexes. HOPPER may be correct in this, but such a reconstruction is not mandatory. As is apparent from the following table of correspondences, the reflexes found in the daughter languages are either plain voiced stops or sounds that can easily be derived from plain voiced stops in the majority of cases. It is, therefore, possible that this series was characterized by full voicing and that the development of murmured stops was a late innovation shared by the ancestors of Indo-Iranian, Italic, Greek, and Armenian.

Correspondences:

Late Indo-European	b	d	g	gʷ
Sanskrit	bh	dh	h	gh h
Avestan	b	d	z	g γ ǰ ž
Albanian	b	d dh	z dh d	g gj
Armenian	b w	d	ǰ z	g ǰ ž
Old Ch. Sl.	b	d	z	g ž dz
Lithuanian	b	d	ž	g
Gothic	b	d	g	w
Old Irish	b	d	g	
Oscan	f		h	f
Latin	f b	f d	h g f	f v gu
Greek	φ	θ	χ	φ θ χ
Tocharian	p	t c ts	k ç	ku k ç

The following table of correspondences combines the table of the glottalic stops with that of the murmured stops. This helps to bring the developments of the two series into clear focus, especially where the reflexes of the glottalic stops have merged with those of the murmured stops. The labial series is not given since there probably was no glottalized labial in Indo-European.

Late Indo-European	tˀ	d	kˀ	g	kˀʷ	gʷ
Sanskrit	d	dh	j	h	g j	gh h
Avestan	d		z		g γ ǰ ž	
Albanian	d dh		z dh d		g gj	
Armenian	t	d	c	ǰ z	k	g ǰ ž
Old Ch. Sl.	d		z		g ž dz	
Lithuanian	d		ž		g	
Gothic	t	d	k	g	q k	w
Old Irish	d		g		b g	g
Oscan	d	f	g	h	b	f
Latin	d	f d	g	h g f	v gu g	f v gu
Greek	δ	θ	γ	χ	β δ γ	φ θ χ
Tocharian	t c ts		k ç		ku k ç	

8. *Disintegrating Indo-European.*

We can say with a reasonable amount of certainty that the form of Indo-European spoken immediately prior to the emergence of the Non-Anatolian daugther languages was not a unitary language but, rather, a group of closely-related dialect groups. The following dialect groups may be set up (cf. BURROW 1973 : 12f.) :

1. A central, innovating area in which the velars are partially palatalized and the labialized postvelars are delabialized and merged with the unpalatalized velars :

$$\begin{tikzcd}
k \arrow[r, dash] \arrow[d] \arrow[dr] & k^{w} \arrow[d] & & k^{ʔ} \arrow[r, dash] \arrow[d] \arrow[dr] & k^{ʔw} \arrow[d] & & g \arrow[r, dash] \arrow[d] \arrow[dr] & g^{w} \arrow[d] \\
c \arrow[r, dash] & k & & c^{ʔ} \arrow[r, dash] & k^{ʔ} & & ɟ \arrow[r, dash] & g
\end{tikzcd}$$

2. A Western group that later develops into Germanic, Celtic, and Italic.
3. A Southern dialect that develops into Greek.
4. An Eastern dialect that develops into Tocharian.

It should be noted that many important isoglosses cross between each of these groups.

Now that we have discussed the changes made during this century, we are in a position to set up phonological systems for the dialects of Disintegrating Indo-European and to trace the development of these phonological systems in the daughter languages. Two such systems must be set up : one for the Disintegrating Indo-European antecedent of the satem languages and one for the antecedents of the centum languages.

The phonological system of the Disintegrating Indo-European antecedent of the satem languages may be reconstructed as follows (cf. BOMHARD 1975 : §6.1) :

Consonants :

b	p	d	t	ɟ	c	g	k		
			$t^{ʔ}$		$c^{ʔ}$		$k^{ʔ}$		
			s					h	[h̥, h]

Vowels :

e o a i u
ē ō ā ī ū

Resonants :

$$y \quad w \quad m \quad n \quad l \quad r \quad \begin{bmatrix} i & u & m̥ & n̥ & l̥ & r̥ \\ y & w & m & n & l & r \end{bmatrix}$$

In the centum dialects, the velars were not palatalized, and the labiovelars were not delabialized (cf. §5; **Bomhard** 1975: §6.9; **Meillet** 1967: 68f.). The phonological system of the Disintegrating Indo-European antecedents of the centum languages may be reconstructed as follows (cf. **Bomhard** 1975: §6.8):

Consonants:

b p	d t	g k	gʷ kʷ	
	tˀ	kˀ	kˀʷ	
	s			h [ḫ̥, h]

Vowels:

e	o	a	i	u
ē	ō	ā	ī	ū

Resonants:

y	w	m	n	l	r	[i	u	m̥	n̥	l̥	r̥]
						[y	w	m	n	l	r]

9. *Indo-Iranian.*

The phonological system of the Disintegrating Indo-Europea antecedent of the satem languages remained intact in the earliest stage of Indo-Iranian except that the voiceless aspirates became phonemic. While Indo-Iranian was still in contact with the ancestor of Slavic, *s* was changed to *š* after *k, r, i, u*. A similar change is also found in Slavic. In Lithuanian, *s* becomes *š* only after *k* and *r* and, in Armenian, only after *r*. The palatals *c, cˀ*, and *j* are affricated to *ċ, ċˀ*, and *ż* respectively (cf. **Burrow** 1973: 74). Following that, *k, kˀ*, and *g* are palatalized to *c, cˀ*, and *j* respectively before *ē̆, ī̆*, and *y* (cf. **Mayrhofer** 1972: 24). The consonantal system of the Indo-Iranian parent language was thus as follows:

p pʰ	t tʰ tˀ	ċ ċˀ	c cˀ	k kʰ kˀ	
bʰ	dʰ	żʰ	jʰ	gʰ	
	s	š			h

The above system has several typological parallels. Similar systems can be found in Kashaya, Kiowa, Lezghian, Tabasaran, Tsaxur, and Yuchi (cf. **Ruhlen** 1976).

After the palatalization of the velars had taken place, the short vowels merged into *a*, and the long vowels merged into *ā*. Original *o* became *ā* in open syllables (**Brugmann**'s Law). The syllabic nasals became *a*, and the syllabic laryngeal merged with *i*. *h* was then lost after *a* (< *m̥, n̥*) with compensatory lengthening. *r* and *l* merge into *r*, and *r̥* and *l̥* merge into *r̥*.

In Avestan and Old Persian, the glottalics merge with the murmured stops. The voiceless aspirates become fricatives except after a sibilant, where they are deaspirated. The plain voiceless stops develop into fricatives when immediately followed by a consonant unless a sibilant precedes.

GRASSMANN's Law describes similar, but independent, developments in Greek and Old Indic (cf. BURROW 1973 : 70). In Old indic, the first murmured stop occurring in a root was changed into the corresponding plain voiced stop when another murmured stop followed. In Greek, the first voiceless aspirate was changed into the corresponding plain voiceless stop when another voiceless aspirate followed. For example, in Old Indic, earlier **bhu-bhodh-a* has become *bu-bodh-a*. Two murmured stops were allowed in Old Indic when one was part of an ending.

Development of the Indo-Iranian consonants in Old Persian, Avestan, and Old Indic :

Indo-Iranian	Old Persian	Gathic Avestan	Later Avestan	Old Indic
p	p f	p f	p f	p
p^h	f	f	f	ph
b^h	b	b	b w	bh
t	t θ	t θ	t θ	t
t^h	θ	θ	θ	th
$t^ʔ$	d	d	d δ̑	d
d^h	d	d	d δ̑	dh
s	h s	h s	h s	s ḥ
ċ (< IE c)	θ s	s	s	ś
$ċ^ʔ$ (< IE $c^ʔ$)	d z	z	z	j
$ż^h$ (< IE ɉ)	d z	z	z	h
š (< IE s)	š	š	š	ṣ
c (< IE k)	c š	č š	č š	c
$c^ʔ$ (< IE $k^ʔ$)	j	ǰ	ǰ ž	j
$ɉ^h$ (< IE g)	j	ǰ	ǰ ž	h
k	k x	k x	k x	k
k^h	x	x	x	kh
$k^ʔ$	g	g	g γ	g
g^h	g	g	g γ	gh

In Old Indic, the glottalics become plain voiced stops but do not merge with the murmured stops. *$c^ʔ$* and *$ċ^ʔ$* merge into *j*, and *$ɉ^h$* and *$ż^h$* merge into *h*.

Old Indic phonological system (cf. MAYRHOFER 1972 : § 5) :

Vowels :	a	i	u	e	o	ṛ	ḷ
	ā	ī	ū	ai	au	ṝ	
Consonants :	k	kh	g	gh	ṅ	(velar)	
	c	ch	j	jh	ñ	(palatal)	
	ṭ	ṭh	ḍ	ḍh	ṇ	(cerebral)	
	t	th	d	dh	n	(dental)	
	p	ph	b	bh	m	(labial)	
Semivowels :	y	r	l	v			
Sibilants :	ś	ṣ	s				
Aspirate :	h						
Visarga :	ḥ						
Anusvāra :	ṁ						

Once the above system was established, it remained surprisingly stable for well over three thousand years ; the phonological systems of the modern Indo-Aryan languages remain to this day similar in structure to the phonological system of Old Indic (cf. BLOCH 1965 : 96f.). This fact raises an interesting question about the Indo-European phonological system as reconstructed by the Neogrammarians. Since that system is so close to the phonological system of Old Indic, one wonders why it, too, did not remain stable in the Indo-European daughter languages. It thus seems to be a fair assumption that the Indo-European phonological system was not in fact similar to that of Old Indic and that the Old Indic system is an innovation.

10. *Slavic.*

The glottalized stops merge with the murmured stops at an early date. *kh* becomes *x*. After *k, r, i,* and *u, s* becomes *x* (> *š* before front vowels). A similar change is found in Indo-Iranian. *c* and *j* become *s* and *z* respectively. *k* and *g* are palatalized to *č* and *ž* respectively before front vowels and *j*. *m̥, n̥, l̥, r̥* develop into *i* (or *u*) plus *m, n, l, r.*

a and *o* merge into *o*, and *ā* and *ō* merge into *a. ei* and *ī* both become *i,* and *oi* (< *ai, oi*) and *ē* both become *ě. ū* becomes *y. i* becomes *ĭ,* and *u* becomes *ŭ. e* plus a nasal becomes *ę*, and *o* plus a nasal becomes *ǫ. ou* (< *au, ou*) becomes *u.*

k and *g* are palatalized to *c* and *dz* respectively before *ě* (< *oi*). *t, d, n, l, r* plus the semivowel *j* become t^j d^j, n^j, l^j, r^j respectively, while *s* becomes *š,* and *z* becomes *ž* under the same conditions. *p, b, m, v* plus *j* become pl^j, bl^j, ml^j, vl^j respectively.

Common Slavic phonological system (cf. BIDWELL 1963 : 12) :

Stops :	p	t			k	Vowels :	i	y				u
	b	d			g		ĭ				ŭ	
Fricatives :	(v)	s		š	x		ę	e			o	ǫ
		z		ž					ě	a		
Affricates :		c	t^j	č		Semivowel :		j (v)				
		dz	d^j									
Nasals :	m	n	n^j			Liquids :	r	l	r^j	l^j		

11. *Baltic.*

The Baltic developments are fairly similar to the early Slavic developments. As in Slavic, the glottalized stops merge completely with the murmured stops, Lithuanian shows the change of *s* to *š* after *k* and *r* but not after *i* and *u* as in Slavic and Indo-Iranian. *m̥, n̥, l̥, r̥* develop into *i* (or *u*) plus *m, n, l, r.*

Except for the merger of *a* and *o* into *a, ai* and *oi* into *ai,* and *au* and *ou* into *au,* the vowel system remains reasonably faithful to that of Disintegrating Indo-European. Unlike Slavic and Germanic, Baltic did not merge Disintegrating IE *ō* and *ā.*

In Lithuanian, *t* plus *j* and *d* plus *j* become *či* and *dži* respectively ; *t* plus *l* and *d* plus *l* become *kl* and *gl* respectively.

12. *Armenian.*

Armenian is particularly important because it is a relic area in which the Disintegrating Indo-European consonant system has been most faithfully preserved. The only other such relic area is Germanic.

Initially, IE *p* becomes either *h* or *Ø* (especially before *o*), while medially, *p* becomes *w.* IE *t* remains after *s* but becomes t^h elsewhere except before *r* and *ł,* where it becomes *w.* IE *c* becomes *s.*

In Armenian, as in Germanic, the glottalics are deglottalized : $t^{ʔ}$ becomes *t,* $c^{ʔ}$ becomes *c,* and $k^{ʔ}$ becomes *k.*

The murmured stops remain except for the following changes : medially between vowels, *b* becomes *w, j* becomes *z,* and *g* becomes *ž. g* remains initially before back vowels but is changed to *ǰ* before front vowels.

The development of the Disintegrating Indo-European consonant system in Armenian may be summarized thus :

p, t, c, k > h (w, Ø), t^h, s, k^h
p^h, t^h, k^h > p^h, t^h, x
t?, c?, k?,> t, c, k
b, d, ɟ, g > b (w), d, j (z), g (ǰ, ž)

The short vowels remain unchanged, but *ē* becomes *i*, *ō* becomes *u*, and *ā* becomes *a*. *i/ī* and *u/ū* lose any distinction of length. *eu* and *ou* become *oy*, *ai* becomes *ay*, *au* becomes *aw*, and *ei* and *oi* become *ē*.

m̥, *n̥*, *l̥*, *r̥*, develop into *a* plus *m*, *n*, *ł*, *r* (*ṙ* before *n*). *l* becomes *ł* before consonants. *w* becomes *g* or *v*.

s becomes *h* or *Ø* initially before vowels. As in Indo-Iranian, Slavic, and Lithuanian, *s* becomes *š* after *r*. *sk* and *ks* become *ç*.

Armenian is the only Non-Anatolian daughter language that has preserved a trace of a consonantal laryngeal. STURTEVANT's *x* (KURYŁOWICZ's $ə_2$) appears as *h* initially before full-grade vowels (cf. BOMHARD 1976 : §12.11 ; WINTER 1965 : 102). The following examples have cognates in the Anatolian languages :

A. Arm. *hav* " grandfather " : Hitt. *ḫuḫḫaš* " grandfather " ; Hier. *huhas* ; Lyc. *χuga-*. Cf. also Lat. *avus* " grandfather ".

B. Arm. *hoviw* " shepherd " : Luw. *ḫa-a-ú-i-iš* " sheep " ; Hier. *hawis*. Cf. also Skt. *ávi-ḥ* " sheep " ; Gk. ὄϊς, οἶς ; Lat. *ovis*.

C. Arm. *haravunk*^{h} " arable land " : Hitt. *ḫaršzi* " to plow ". Cf. also Gk. ἀρόω " to plow, till " ; Lat *arō* ; Goth. *arjan*.

D. Arm. *hogi* " wind, spirit ", *hov* " wind ", *hovem* " to let air in " : Hitt. *ḫuwanza* " wind ". Cf. also Lat. *ventus* " wind " ; Goth. *winds* ; Toch. A *want*.

E. Arm. *han* " grandmother " : Hitt. *ḫannaš* " grandmother " ; Lyc. *χñna-*. Cf. also Lat. *anus* " old woman ".

F. Arm. *harkanem* " to split, fell " : Hitt. *ḫarakzi* " to be destroyed ". Cf. also OIr. *orgaim* " to strike, destroy ".

G. Arm. *hanem* " to draw " : Hitt. *ḫani* " to draw water ".

H. Arm. *Hay* " Armenian " : Hitt. *Ḫayaša* the name of a region.

The following have no known cognates in the Anatolian languages :

A. Arm. *hav* " bird " : Lat. *avis* " bird " ; Skt. *ví-ḥ*.
B. Arm. *hot* " smell " : Lat. *odor* " smell " ; Gk. ὄζω " to smell ".
C. Arm. *hum* " raw " : Skt. *āmá-ḥ* " raw " ; Gk. ὠμός.
D. Arm. *haçi* " ash-tree " : OIce. *askr* " ash-tree ".

These examples, though few in number, seem to indicate that the laryngeal *x* was not lost initially before vowels in Disintegrating Indo-European.

13. *Germanic.*

Germanic, like Armenian, is extremely conservative. The Disintegrating Indo-European consonant system is preserved better in these two branches than in any of the other daughter languages. Unlike Armenian, Germanic preserves the older contrast between velars and labiovelars. Armenian, on the other hand, belongs to the satem group of languages and is, therefore, descended from that form of Disintegrating Indo-European in which this contrast was replaced by a contrast between palatals and velars (cf. §5). Furthermore, the voiceless aspirates did not become phonemic in Germanic. As in Armenian, the glottalics are deglottalized.

The plain voiceless stops are changed into voiceless fricatives: *p* becomes *f*, *t* becomes *θ*, *k* becomes *χ*, and k^w becomes *χw*. Later, the voiceless fricatives were voiced except 1) initially and 2) medially between vowels when the accent fell on the contiguous preceding syllable (VERNER's Law). *s* was also changed to *z* under the same conditions.

b remained initially, in gemination, and after nasals; *g* only in gemination and after nasals; and *d* initially, in gemination, and after nasals, *l*, *z*, and *g*. In other positions, however, *b*, *d*, and *g* were changed into the voiced fricatives *β*, *ð* and *γ* respectively (cf. MOULTON 1972: 173). g^w seems to have become *w*.

a and *o* merge into *a*, and *ā* and *ō* merge into *ō*. *e* becomes *i* 1) before a nasal plus consonant and 2) when *i*, *ī*, or *y* follows. *ei* becomes *ī*. *i* is changed to *e* and *u* to *o* when *a*, *o*, or *e* appears in the following syllable except when a nasal plus consonant intervenes. In the sequences *anχ*, *inχ*, and *unχ*, the *n* is lost, and the vowels are lengthened. *m̥*, *n̥*, *l̥*, *r̥* develop into *u* plus *m*, *n*, *l*, *r*.

The consonantal resonants remain unchanged except that final *m* becomes *n*. This change is also found in Anatolian, Greek, Celtic, and probably Balto-Slavic.

14. *Celtic.*

The discussion will be confined to Old Irish; only the major developments will be followed. For details about developments in the other Celtic languages, cf. LEWIS-PEDERSEN 1961.

The dental and velar glottalics merged completely with the murmured stops in Proto-Celtic: $t^ʔ$ and $d > d$, and $k^ʔ$ and $g > g$. The labiovelars developed along slightly different lines. First, g^w was delabialized. The resulting sound then merged with *g*. Following that, $k^{ʔw}$ developed 1) into *b* initially and medially after consonants and 2) into *g* initially before *u* and medially between vowels and before consonants.

Original *p* was lost in all of the Celtic languages. However, *p* has been reintroduced into Old Irish through loanwords. *t* and *k* are written *t* and *c* respectively. *b, d,* and *g* remain.

The consonants developed positional allophones under various conditions: Palatal allophones developed in the vicinity of original *i, ī, e, ē,* and velar allophones developed in the vicinity of original *u, ū.* Neutral allophones were found in the vicinity of original *o, ō, a, ā.* In Old Irish, the palatal and velar allophones were indicated as such in writing by surrounding vowels. Unpronounced vowels were often introduced to indicate the quality of the following consonant. *p, t, c, b, d, g* became the fricatives *f, θ, χ, v, ð, γ* (written *ph, th, ch, b, d, g*) initially after words that end or that formerly ended in a vowel and medially between vowels. *m, n, l, r* became *μ, ν, λ, ϱ* (written *m, n, l, r*), and *s* became *h* under the same conditions. *μ* was probably a nasalized *v*, while *ν, λ, ϱ* were lax variants of *n, l, r.* Consonants were changed as follows initially when the preceding word ended or formerly ended in a nasal: 1) *p, t, c* became *b, d, g* (written *p, t, c*), 2) *b, d* first became *mb, nd* and then *mm, nn,* 3) *f* became *v* (written *b*), 4) *n* was written before vowels, and 5) *s, r, l, m, n* were doubled when they followed a proclitic vowel.

Old Irish thus had the following system of consonants (the written form is given first followed by the allophones in brackets):

p	[p, b]	t	[t, d]	c	[k, g]
ph	[f]	th	[θ]	ch	[χ]
f	[f]	s	[s]		
b	[b, v,]	d	[d, ð]	g	[g, γ]
m	[m, μ]	n	[n, ν]	n	[ŋ]
		l	[l, λ]	r	[r, ϱ]
		h	[h]		

Except for the merger of *ō* and *ā* into *á* and of *ī* and *ē* into *í,* the long and short vowels are mostly preserved in accented syllables. In unaccented syllables, vowels are either lost or subject to various modifications governed by a complicated set of rules. *i* and *u* become *e* and *o* respectively under the influence of *a* or *o* in the following syllable. *eu* and *ou* merge into *ó/úa. au* becomes *áu/ó, ei* becomes *é/ía, oi* becomes *óe/oí,* and *ai* becomes *aí/áe* in accented syllables. The Old Irish vowel system was as follows:

Vowels:

i u í ú
e o é ó
a á

Diphthongs:

íu ía úa uí
éu/éo oí/óe
áu aí/áe

y is lost. *w* becomes *f* initially and *b* after *r, l, d. m, n, l, r* are preserved except that final *m* becomes *n*. In the sequences *Vnt, Vnc(h)*, and *Vns*, the *n* is lost, and the preceding vowel is lengthened. The developments of the syllabic nasals and liquids are complicated though in general *m̥, n̥, l̥, r̥* become *am, an, al, ar* respectively before vowels and *em, en, li* (*le*), *ri* (*re*) respectively elsewhere.

15. *Italic.*

As in Greek, the murmured stops became voiceless aspirates in Italic (cf. Buck 1955 : 118 ; Hopper 1973 : §3.3.2) : $b, d, g, g^w > p^h, t^h, k^h, k^{wh}$. The voiceless aspirates then became the fricatives *f, θ, χ, χw*. In Oscan and Umbrian, *f, θ,* and *χw* merged into *f*, while *χ* became *h*. In Latin, the merger of *f, θ,* and *χw* into *f* only took place initially. *f* became *b* medially ; *θ* became 1) *d* medially but 2) *b* before or after *r*, before *l*, or after *u* ; and *χw* became 1) *v* between vowels, 2) *gu* after *n*, but 3) *g* before consonants or *u*. *χ* became 1) *h* initially in Latin but 2) *g* when before or after consonants and 3) *f* when before *u*.

After the murmured stops had become voiceless aspirates, the glottalics became plain voiced stops. The identical development is found in Greek. The plain voiceless stops remain unchanged.

The vowels generally remain in accented syllables but are weakened or lost in unaccented syllables. The vowels underwent the following modifications in Latin (cf. Buck 1955 : 79f.) : Final *i* became *e*. *e* became *i* before *ng, gn, nc*, and *nqu*. *e* became *o* before or after *w* and before *l*. *o* became *u* 1) before *nc, ngu, mb*, and before *l* plus a consonant, 2) in final syllables ending in a consonant, and 3) medially before *l* or before two consonants. *vo* became *ve* before *r* plus a consonant, before *s* plus a consonant, and before *t*. *ov* became *av*.

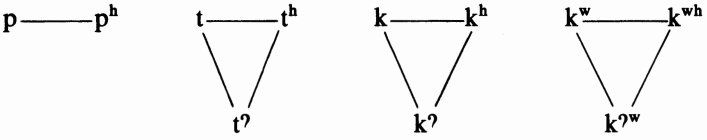
The diphthongs are preserved in Oscan but undergo various changes in Umbrian and Latin. *ei* became *ī*, and *oi, eu*, and *ou* became *ū* in Latin.

m, n. l, r are preserved. *y* remains initially in Latin (written *i*) but is lost between vowels, while *w* (written *v*) is unchanged. *m̥, n̥, l̥, r̥* develop into *a* plus *m, n, l, r* respectively before vowels. Elsewhere, *l̥* and *r̥* become *ol* and *or* respectively, and *m̥* and *n̥* become *em* and *en* respectively.

s generally remains, though it is voiced to *z* between vowels. The *z* is still found in Oscan but is changed to *r* in Umbrian and Latin.

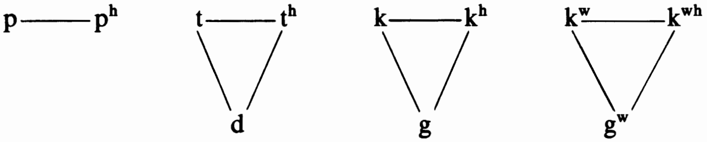
16. *Greek.*

The Greek and Italic sound-shifts represent a complete transformation of the Indo-European type. In Greek, as in Italic, the murmured stops first became voiceless aspirates (cf. Lejeune 1972 : 30f.). This development resulted in a consonant system characterized by a contrast between three types of voiceless stops, plain ~ aspirated ~ glottalized :



Similar systems can be found in Aymara, Chumash, Haisla, Keres, Korean, and Takelma (cf. RUHLEN 1976).

The glottalics then became plain voiced stops. The resulting (Proto-Greek) system was as follows :



Such system are extremely common, being found in Bisu, Burmese, Burushaski, Cofan, Gilyak, Guanano, Thai, Waunana, and Yaruro, to cite just a few examples (cf. RUHLEN 1976).

The labiovelars were eliminated in Greek in historic times. The process of elimination probably occurred in several stages. Since the labiovelars mostly remain in Mycenaean, we can reasonably place their elimination between the Mycenaean period and the beginning of the alphabetic period, that is, between about 1400-900 B.C. (cf. LEJEUNE 1972: 43f.). Before or after *u*, k^w, g^w, and k^{wh} were delabialized and merged with *k*, *g*, and k^h (written κ, γ, and χ) respectively. Next, k^w, g^w, and k^{wh} were palatalized before *ē̆* and *ī̆*. The resulting sounds then merged with *t*, *d*, and t^h (written τ, δ, and θ) respectively in the majority of the dialects. Finally, all remaining labialized postvelars became labials : k^w, g^w, $k^{wh} > p$, *b*, p^h (written π, β, φ).

The vowels and diphthongs are well-preserved in all of the Greek dialects. The most important change is that of *ā* to *η* in Attic-Ionic. Additional changes worth mentioning include the compensatory lengthening of short vowels, the shortening of long vowels, and the development of new long vowels and diphthongs through contraction. For details about these developments, cf. LEJEUNE 1972 : 187f.

m, *n*, *l*, *r* generally remain in Greek except that final *m* becomes *n* as in Anatolian, Germanic, Celtic, Baltic, and Slavic. *m̥*, *n̥*, *l̥*, *r̥* develop into *αμ*, *αν*, *αλ*, *αϱ* respectively before vowels. Before consonants, *m̥* and *n̥* merge into *a*, while *r̥* and *l̥* become *αϱ/ϱα* and *αλ/λα* respectively.

s, y, and *w* are lost medially between vowels. Initially before vowels, *s* becomes *h* (written ʽ), *y* becomes either *h* or *z* (written ʽ and ζ respectively), while *w* is lost in Attic-Ionic. *s* remains when final and before or after voiceless stops.

17. *Tocharian.*

In Tocharian, the distinction between voiced, voiceless, and glottalized stops was eliminated. However, Tocharian originally preserved the older contrast. While this contrast still existed, $t^{ʔ}$ was lost before the nonsyllabic resonants (cf. van Windekens 1976 : §241). *t* and *d* were not lost, however. The elimination of the older contrast must, therefore, have taken place after the loss of $t^{ʔ}$. No doubt, the first step involved the deglottalization of $t^{ʔ}$, $k^{ʔ}$, and $k^{ʔw}$ and their merger with the plain voiceless stops *t, k*, and k^{w} respectively. This is proved by the fact that *mp* remains *mp*, while *mb* becomes *m* (cf. van Windekens 1976 : §234), and the fact that *t* and $t^{ʔ}$ have the same treatment before front vowels — palatalization to *c* — while *d* goes its own way under the same conditions — palatization to *dz* > *ts* (cf. van Windekens 1976 : §243).Finally, the voiced stops were devoiced and merged with the plain voiceless stops.

p (< *p, b*) often becomes *w* between vowels and after *l* and *r*. *k* (< *k*, $k^{ʔ}$, *g*) is palatalized to *ç* before front vowels. k^{w} (< k^{w}, $k^{ʔw}$, g^{w}) becomes *kw/u*, *k*, or *ç* according to a complicated set of rules (cf. van Windekens 1976 : 91f. for details). *t* (< *t*, $t^{ʔ}$) becomes *c* before front vowels but *ts* before *y*. *t* (< *d*) becomes *ts* before front vowels (see above).

s usually remains but is palatized to *ş* before front vowels. The nonsyllabic resonants generally remain.

The Disintegrating Indo-European vowels and diphthongs are greatly modified. For details about their development, cf. van Windekens 1976 : 15f.

18. *Anatolian.*

The Anatolian languages occupy a special position since it is extremely likely that they are descended from an earlier form of Indo-European than the other daughter languages (cf. Burrow 1973 : 17f. ; Sturtevant 1942 : 23f.). In my article entitled “ The Placing of the Anatolian Languages ”, I tried to show that it was at the end of the phonemic pitch stage of Indo-European that the Anatolian languages became separated from the main speech community (cf. Bomhard 1976).

We may reconstruct the Pitch Indo-European phonological system as follows (cf. **Bomhard** 1975 : §4.1 and 1976 : §2.1) :

Consonants :

b p	d t	g k	g^w k^w	
	$t^ʔ$	$k^ʔ$	$k^{ʔw}$	ʔ
	s	γ x		h

Vowels :

a i u
ā ī ū

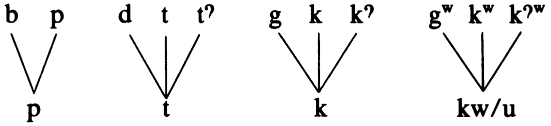
Resonants :

$$y \quad w \quad m \quad n \quad l \quad r \begin{bmatrix} i & u & m̥ & n̥ & l̥ & r̥ \\ y & w & m & n & l & r \end{bmatrix}$$

During the phonemic pitch stage of Indo-European, pitch-conditioned allophones of *a* and *ā* came into being. Under high pitch, these vowels had front allophones ; under low pitch, then had back allophones. These allophones developed along slightly different lines in Proto-Anatolian and in Late Indo-European. In both Proto-Anatolian and Late Indo-European, the front allophones became *e* and *ē* respectively except when contiguous with the laryngeals *h* and *x* (cf. §3 ; **Bomhard** 1975 : §5.5 and 1976 : §7.3). The back allophones, on the other hand, remained subphonemic in the Anatolian languages (cf. **Bomhard** 1976 : §7.3), while in Late Indo-European, they became *o* and *ō* respectively.

PAn. *e* was originally preserved in Hittite, though eventually it merged with *i*. Luwian, Palaic, and Hieroglyphic Luwian have mostly replaced PAn. *e* with *a*. PAn. *a* remained in all of the Anatolian daughter languages. *i* and *u* also remained. The cuneiform syllabary does not indicate vowel length. However, internal evidence points to a contrast between long and short vowels at least in Proto-Anatolian. Pitch IE *ai* and *au* become *i* and *u* respectively.

In the Anatolian languages, the glottalized stops were deglottalized, and the voiced stops were devoiced. The cumulative evidence seems to indicate that the older Anatolian languages had only voiceless stops (cf. **Bomhard** 1976 : §11.1). It also seems likely that the labiovelars became clusters of gutturals plus *w/u* (cf. **Bomhard** 1976 : §11.2 ; **Sturtevant** 1951 : §62a and §78) :



m, n, l, r remain, but final *m* becomes *n*. *m̥, n̥, l̥, r̥* develop into *a* plus *m, n, l, r*. *s, y,* and *w* remain.

The most salient characteristic of the Anatolian languages is their preservation of two of the Indo-European laryngeals, namely *x* and *γ*. As with the stops, the voiced ~ voiceless contrast was lost, so that Anatolian *x* represents both IE *x* and *γ*. The laryngeals ˀ and *h* were completely lost. For details about the treatment of the laryngeals in Anatolian, cf. BOMHARD 1976 : §§12.1-12.10 and STURTEVANT 1951 : 47f.

19. *Old Indic Accentuation.*

Vedic Sanskrit (Old Indic), like ancient Greek, had a system of accentuation in which pitch (musical tone) was dominant. Every word, except certain enclitics, bore an accent; however, there was only one accented syllable per word. The accented syllable had high pitch (*udātta-* " raised, elevated, high "). All other syllables had low pitch (*anudātta-* " not raised ") except 1) the syllable directly preceding the *udātta-* which was pronounced lower than normal (*sannatara-* " lower " or *anudāttatara-* " lower than *anudātta-* "), and 2) the syllable directly following the *udātta-* (provided there was no *udātta-* or *svarita-* in the syllable following that), which began at the high level of *udātta-* and then slowly fell to the level of *anudātta-*. The accent of this syllable was called the enclitic (or dependent) *svarita-*. A so-called " independent *svarita-* " also existed, but this was always of secondary derivation, having arisen from the contraction of two syllables, the first of which had high pitch and the second low pitch, into a single syllable. The independent *svarita-* was thus a compound intonation comparable to the Greek circumflex. The enclitic *svarita-* differed from the independent *svarita-* in that the former could never appear alone, being totally dependent on a preceding *udātta-* for its existence, while the latter could appear alone as the main accent of a word. Also, the enclitic *svarita-* was a falling intonation, while the independent *svarita-* was a compound, rising-falling intonation.

Phonemically, Sanskrit had level pitches, with the main contrast being between the high pitch of the accented syllable and the low pitch of the other syllables. However, the voice did not rise abruptly from low pitch to high pitch or fall abruptly from high pitch to low pitch, but, rather, both ascent and descent were characterized by clearly audible glides. Thus, the pitch of the accented syllable began at the low level of the positionally-conditioned *sannatara-* and quickly rose to the level of *udātta-*. The pitch was then maintained at a high level until the end of the syllable. Similarly, the pitch of the syllable following the accented syllable began at the high level of *udātta-* and quickly fell to the level of *anudātta-*.

The native grammarians say nothing about stress, and there is nothing to indicate, such as, for example, vowel weakenings or losses, that the language of the Vedas possessed a strong stress accent. There are, however, remnants of an earlier, Indo-European system, manifest in the quantitative vowel gradation, in which stress played an important part. Stress replaced pitch in the spoken language (Classical Sanskrit) only when the latter became extinct in the first centuries of the Christian era (cf. BURROW 1973 : 115).

The Sanskrit accent was free (mobile), that is, not tied to a particular syllable, as, for example, in Czech with its fixed initial accent or Polish with its fixed penultimate accent, but able to fall on any syllable, initial, medial, or final. The position of the accent was morphologically-conditioned, its place in a word having been used as a means to differentiate grammatical categories. However, the accent was seldom so used alone but, rather, in conjunction with vowel gradation and/or inflectional endings. Take, for example, the declension of *pad-* " foot " : in the singular, the strong cases are differentiated from the weak cases both by the position of the accent and by changes in the vowel grade of the stem. Furthermore, each case is characterized by a special ending :

Strong Cases :		Weak Cases :	
nom.	*pā́t*	instr.	*pad-ā́*
acc.	*pā́d-am*	dat.	*pad-é*
		gen.-abl.	*pad-ás*
		loc.	*pad-í*

The following were used enclitically and had no accent of their own, being dependent upon the words with which they were in combination for accent : 1) certain particles such as *iva, u, ca, vā,* etc. ; 2) the personal pronouns *mā, me, nau, nas, tvā, te, vām,* and *vas* ; 3) the demonstrative pronouns *ena-* and *tva-* ; and 4) the indefinite pronoun *sama-*. Loss of accent also occurred in verbs in an independent clause, unless they stood at the beginning of the clause, and in nouns in the vocative, unless they stood at the beginning of a sentence.

20. *Greek Accentuation.*

Greek too had a system of accentuation based on variations in pitch. As in Sanskrit, every word bore an intonation except certain proclitics and enclitics ; however, each word normally had only one accented syllable. The accented syllable had either the acute accent (ὀξεῖα), which was one of high pitch (cf. Skt. *udātta-*), or the circumflex accent (περισπωμένη, δίτονος, ὀξυβαρεῖα), which was a combination of rising-falling pitch (cf. Skt. independent *svarita-*). The circumflex could fall only on long vowels and diphthongs, while the acute could fall on any vowel regardless of quantity. All unaccented syllables had the grave accent (βαρεῖα), which was one of low pitch (cf. Skt. *anudātta-*), except for the syllable directly following the accented syllable, which had a falling intonation comparable to the enclitic *svarita-* in Sanskrit. The grammarian Tyrannion referred to the accent of this syllable as μέσος " middle ", that is, midway between acute and grave.

Unlike the Sanskrit accent, which could fall on any syllable, the Greek accent was restricted to one of the final three syllables of a word. This restriction was a Greek innovation and was not inherited from Indo-European. Furthermore, the position of the accent within the final three syllables was regulated by the length of the ultima. These developments affected the distribution of the pitch thus : the acute could fall only on one of the last three syllables of a word if the ultima were short or on one of the last two syllables if the ultima were long, while the circumflex could fall only on long vowels and diphthongs in the penultimate syllable if the ultima were short or on the ultima itself if it were long. To state things slightly differently and more accurately, the position of the accent could be no further back from the end of the word than three morae if the ultima contained two morae. However, if the ultima contained only one mora, the position of the accent could be as far back as the last mora of the antepenult. In the latter case, the number of morae in the penult was irrelevant, either one or two being permissible. This means that the following patterns were possible :

∪́ | ∪ | ∪ ; ∪ ∪́ | ∪ | ∪ ; ∪́ | ∪ ∪ | ∪ ; ∪ ∪́ | ∪ ∪ | ∪ ; ∪́ | ∪ ∪ ; ∪ ∪́ | ∪ ∪.

The grave accent, which was originally considered as the regular intonation of unmarked syllables, was later used in writing as a replacement for the acute on the last syllable of a word when standing before another word in the same sentence.

Since the Greek accent could fall only on one of the final three syllables, an accent originally falling on any other syllable was moved forward to fall on either the antepenult or the penult, depending upon length of the ultima. However, if the accent originally fell on one of the last three syllables, its position was usually maintained, the main exception being the widespread shift of the accent from the ultima to the penult in words ending in a dactyl (- ∪ ∪) : ποικίλος ⟨ *ποικιλός, cf. Skt. *peśalá-ḥ* ; ἀγκύλος ⟨ *ἀγκυλός, cf. Skt. *aṅkurá-ḥ*.

On verbs, regardless of its original position, the accent was thrown back as far toward the front of the word as the rules of accentuation would allow.

Even though the ancient ability of the accent to fall on any syllable was restricted in Greek, the ancient function of accentuation was maintained.

As in Sanskrit, the position of the accent within a word was used as a means to indicate grammatical relationships. For example, in the declension of πούς " foot " (cf. Skt. *pā́t* " foot "), the accent falls on the base in the strong cases but on the ending in the weak cases :

	Singular	Dual	Plural
nom.	πούς	πόδ-ε	πόδ-ες
acc.	πόδ-α		πόδ-ας
gen. (-abl.)	ποδ-ός	ποδ-οῖν	ποδ-ῶν
dat.	ποδ-ί		Hom. ποσ-σί Att. ποσί

Greek possessed a certain number of words that had no accent of their own. These words were used in combination with other words. Some of these unaccented words were inherited from Indo-European, while others arose in Greek itself. They fall into two categories : 1) the proclitics, which were combined with a following word, and 2) the enclitics, which were combined with a preceding word. The proclitics include : 1) the forms of the definite article ὁ, ἡ, οἱ, αἱ ; 2) certain propositions such as ἐν, ἐκ, πϱὸ, ἀνὰ, πεϱὶ, μετὰ, etc. : 3) certain conjunctions ; and 4) the negative adverbs οὐ, οὐκ, οὐχ, μὴ. The enclitics include : 1) certain particles such as τε, γε, νυ, etc. ; 2) the personal pronouns μου, μοι, σου, σοι, σε, οὗ, οἱ, ἑ, etc. ; 3) the indefinite pronoun τις, τι ; 4) certain indefinite adverbs ; and 5) certain forms of the verbs εἰμι " to be " and φημι " to say ".

Notwithstanding the limitations mentioned above for Greek and several other minor modifications on one side or the other, the position of the Greek accent corresponds in the main to the position of the Sanskrit accent. Moreover, both agree 1) in having accent systems characterized by contrasts in pitch rather than by differences in stress, though stress eventually replaced pitch in both ; 2) in the fact that the accent played an important role in morphology ; and 3) in the fact that accent and meter were independent of each other. These similarities clearly indicate that both the Greek and Sanskrit systems of accentuation must have had a common origin.

21. *Germanic Accentuation.*

From the earliest period of development that can be reconstructed, the Germanic system of word accentuation was characterized by stress, there being no indication that pitch was relevant. Though the tonal character of the Indo-European accent was lost, the position of the accent, as established by the correspondence of Sanskrit and Greek, was originally preserved in Proto-Germanic. This is confirmed by VERNER's Law, according to which the position of the accent influenced the development of the voiceless stops. First, IE *p, t, k,* k^w became Gmc. *f, θ, χ, χw.* Then, medial (and final) *f, θ, χ, χw,* together with *s,* became *β, ð, γ, γw,* and *z* except 1) before *s* or *t* and 2) between vowels when the accent fell on the contiguous preceding syllable. Thus, if the accent followed or fell on a noncontiguous preceding syllable, the fricatives became voiced.

Examples :

IE *p* 〉 Gmc. *f* :

A. Skt. *páñca* " five " ; Gk. πέντε 〈 Late IE **pénk*^{w}*e* 〉 Gmc. **'fimfi* 〉 Goth. *fimf* " five " ; OIce. *fimm* ; OE. OS. *fīf* ; OHG. *finf.*

B. Skt. *nápāt* " descendant " ; Lat. *nepōs -tis* " grandson " 〈 Late IE **népōt* 〉 Gmc. **'nefō(ð)* 〉 Oice. *nefi* " nephew " ; OE. *nefa* ; NHG. *Neffe.*

IE t 〉 Gmc. *θ* :

A. Skt. *tráyaḥ* " three " ; Gk. τρεῖς ; Lat. *trēs* 〈 Late IE **tréyes* 〉 Gmc. **'θriyiz* 〉 Goth. *þreis* ; OIce. *þrīr* ; OFris. *thrē.*

B. Skt. *bhrā́tar-* " brother " ; Dor. φρᾱ́τερ- ; Lat. *frāter* 〈 Late IE **bráAter-* 〉 Gmc. **'brōθer* 〉 Goth. *brōþar* ; OE. *brōþor* ; OS. *brōthar.*

IE *k* 〉 Gmc. *χ* :

A. Skt. *śatám* " hundred " ; Gk. ἑκατόν ; Lat. *centum* ; OIr. *cét* ; Lith. *šim̃tas* ; Toch. A *känt* 〈 Late IE **km̥tó-m* 〉 Gmc. **χun'ða-* 〉 Goth. OE. OS. *hund.*

B. Skt. *páśu-* " cattle " ; Lat. *pecū* 〈 Late IE **péku-* 〉 Gmc. **'feχu-* 〉 Goth. *faihu* ; OE. *feoh* ; OS. *fehu* ; OHG. *fihu.*

IE k^w 〉 Gmc. *χw* :

A. Skt. *ká-ḥ* " who ? " ; Lat. *quī* ; Lith. *kàs* 〈 Late IE **k*^{w}*o-* 〉 Gmc. **χwa-* 〉 Gmc. *hwas* ; OIce. *hvar* ; OE. *hwā.*

B. Gk. λείπω " to leave " ; Lith. *liekù* 〈 Late IE **léik*^{w}*ox* 〉 Gmc. **'līχwō* 〉 Goth. *leihwa* ; NGH. (*ich*) *leihe.*

IE *p* 〉 Gmc. *β* :

Skt. *saptá* " seven " ; Gk. ἑπτά ; Lat. *septem* 〈 Late IE **septḿ̥* 〉 Gmc. **si'βun* 〉 Goth. OHG. *sibun* ; OS. *siƀun.*

IE *t* 〉 Gmc. *ð* :

> Skt. *pitár-* " father " ; Gk. πατέϱ- ; Lat. *pater* 〈 Late IE **pAtér-* 〉 Gmc. **fa'ðer-* 〉 Goth. *fadar* ; OIce. *faðir* ; OE. *fæder.*

IE *k* 〉 Gmc. *γ* :

> Skt. *śvaśrū́-* " mother-in-law " 〈 Late IE **swekrúx-* 〉 Gmc. **swe'γrū-* 〉 OE. *sweger* ; OHG. *swigar* ; NHG. *Schwieger.*

IE k^w 〉 Gmc. *γw* :

> Goth. *siuns* " sight " ; OIce. *sjōn* ; OE. *on-sēon* ; OS. *siun* ; OFris. *siōne, siūne* 〈 Gmc. **seγw'ni-z* 〈 Late IE *sek^w*ní-s.*

IE *s* 〉 Gmc. *z* :

> Skt. *snuṣā́* " daughter-in-law " 〈 Late IE **snusáx* 〉 Gmc. **snu'zō* 〉 OIce. *snor* ; OE. *snoru.*

After the sound changes described by Verner's Law had taken place, many Germanic nouns and verbs were characterized by a paradigmatic alternation between forms with voiceless fricatives and forms with voiced fricatives. Even though there was a tendency in the Germanic daughter languages to level out the paradigm, numerous traces of the former alternation remain, especially in the verbs. Take, for example, the verb **'werθan* " to become " :

Gmc.	**'werθō*	**'warθa*	**wurðu'mi*	**wurða'na-z*
Goth.	*wairþa*	*warþ*	*waurþum*	*waurþans*
OIce.	*verða*	*varð*	*urðom*	*orðenn*
OE.	*weorþe*	*wearþ*	*wurdon*	*worden*
OS.	*wirthu*	*warth*	*wurdun*	*gi-wordan*
OHG.	*wirdu*	*ward*	*wurtum*	*gi-wortan*
NHG.	*werde*	*ward* (*wurde*)	*wurden*	*ge-worden*

Compare the Sanskrit verb *vṛt-* " to turn " :

vártāmi   *va-várta*   *va-vṛtimá*   *vṛtaná-ḥ*

Toward the end of the Proto-Germanic period, the old mobile accent was lost, and the stress became fixed on the initial syllable. This new fixed initial stress characterized 1) simple nominal forms, 2) simple verbal forms, and 3) compound nominal forms. Compound verbal forms were accented differently, however. In compound verbal forms, the stress fell on the first syllable of the second member. The verbal compounds, apparently later formations than the nominal compounds, were not strongly joined together, and, therefore, the accent was not shifted to the preverb. The independent nature of the two members of the verbal compounds was still preserved in Gothic, where the enclitic copula *-uh-* " and " could be placed between the preverb and verb. If a nominal compound were composed of two substantives, the initial syllable of the first member had primary stress, and the initial syllable of the following member had secondary stress. The foregoing system of accentuation still prevails in the modern West Germanic languages.

Both Swedish and Norwegian make considerable use of pitch. However, the use of pitch in these two languages has arisen in historical times and does not go back to either Indo-European or Proto-Germanic.

22. *Slavic Accentuation.*

No theory has yet been proposed that can account completely for all of the data relative to the development of accentuation in the Slavic languages. This is due in part to the fact that all knowledge concerning accentuation is drawn solely from the modern languages, that is to say, from about the fourteenth century on, and in part to the fact that the older patterns have been greatly disrupted by subsequent changes. The following discussion closely follows that of SHEVELOV (1964:38f.).

That Late Indo-European had a system of accentuation characterized by contrasts in pitch is confirmed by the evidence of Sanskrit and Greek. Stress was nondistinctive, each syllable being pronounced with more or less equal intensity. The Indo-European dialect from which Proto-Slavic (and Proto-Baltic) descended preserved the tonal character of the accent. However, the position of the accent underwent a systematic displacement.

In Pre-Balto-Slavic Indo-European, the rising pitch was shifted to long monophthongs and long diphthongs. The shift of rising pitch to these positions left falling pitch on all other syllables (cf. SHEVELOV 1964:§ 4.14A). No doubt the loss of laryngeals was the cause of both the accent shift and compensatory vowel lengthening. Eventually, long monophthongs and diphthongs of whatever origin (except when due to contractions) received rising pitch under the influence of the intonation of long monophthongs and diphthongs resulting from the loss of laryngeals. The intonations were not phonemic at this time, depending solely on vowel quantity for their distribution.

The earliest form of Proto-Slavic was probably characterized by a weak fixed penultimate stress (cf. SHEVELOV 1964:§ 4.14B). In addition, Proto-Slavic had rising pitch and falling pitch, but these intonations were not phonemic; rising pitch characterized long monophthongs and long diphthongs, and falling pitch characterized short diphthongs and contractions.

Short monophthongs were apparently tonally nondistinctive (cf. BIDWELL 1963:9; SHEVELOV 1964:§ 4.6). However, STANG (1965:173) maintains that, while short monophthongs were originally tonally nondistinctive, they later had falling pitch in initial syllables and rising pitch elsewhere. The intonations became phonemic when, at a later date, the long diphthongs underwent shortening and merged with the short diphthongs. Even though the former long diphthongs had been shortened, they retained rising pitch. Thus, original short diphthongs had falling pitch, while short diphthongs from original long diphthongs had rising pitch.

After the shortening of long diphthongs had taken place, stress was shifted from a penultimate syllable with falling pitch or short monophthong to a contiguous preceding syllable with rising pitch (cf. SHEVELOV 1964:§ 4.14C). Later, there was a similar shift of stress to a following syllable with rising pitch (cf. SHEVELOV 1964:§ 4.14C; VAILLANT 1950:§ 99). Stress was not shifted in those words that had either rising pitch or falling pitch only on every syllable.

Thus, the Proto-Slavic system of accentuation was dominated by pitch. Even though each syllable had its characteristic pitch, however, it was only under stress that pitch became distinctive. The stress usually fell on the penultimate syllable but was shifted to a contiguous preceding syllable with rising pitch or to a following syllable with rising pitch when the penult contained either falling pitch or a short monophthong. A stressed penult could have either rising pitch or falling pitch depending upon the original quantity of the vowel segment.

When Proto-Slavic began to split up into dialects, the system of accentuation outlined above was destroyed. Two events caused the disruption of the old accent system: First, there was a widespread shortening of long vowels. In some of the Slavic dialects, new long vowels were created through contraction. Next, there was a series of stress shifts. In the South Slavic dialects, the stress shifts were accompanied by shifts in vowel quantity and pitch. It was in the South Slavic area that the so-called " new rising pitch " and " new falling pitch " arose (cf. SHEVELOV 1964:§ 33.14 and § 33.15). The other Slavic dialects, some of which also underwent shifts in quantity, give no evidence of any pitch mutations. Indeed, phonemic pitch was probably lost in the East and West Slavic languages at the time of the stress shifts (cf. SHEVELOV 1964:§ 33.14 and § 33.17).

The various Slavic daughter languages underwent further phonological and morphological developments that affected accentuation. Therefore, none of the modern languages preserve the earlier system of accentuation. Only Serbo-Croatian and Slovene still have phonemic pitch. As far as the other daughter languages go, the former distribution of the pitch is indicated in Czech by the opposition of long vowels and short vowels, in Bulgarian by the position of the stress, and in East Slavic by the accentuation of the groups *oro, ere, olo, ele*.

23. *Celtic Accentuation.*

The accentuation of Old Irish was remarkably similar to that of Late Proto-Germanic. Old Irish had a stress accent that normally fell on the first syllable of a word, the main exception being, as in Germanic, in compound verbal forms where the stress fell on the first syllable of the second member except in the imperative. The stress caused the weakening and loss of unaccented vowels.

In all of the modern Brythonic languages, with the exception of the Vannetais dialect of Breton, the stress falls on the penult. In Vannetais, the stress falls on the ultima. Old Welsh was also accented on the ultima, and it is probable that this was the original position of the accent in all of the Brythonic languages.

24. *Italic Accentuation.*

In Early Latin, as well as in Oscan and Umbrian, the accent fell on the first syllable. That the accent was one of stress is shown by the effect it had on unaccented syllables. The vowel of the initial syllable was never modified, but the vowels of the unaccented syllables were regularly weakened or lost. The syllable directly following the initial syllable underwent the greatest modification, often being completely lost : e.g. Lat. *aetās* 〈 **aevitās*.

Between Early Latin and Classical Latin, the position of the accent was shifted. In Classical Latin, the accent fell on the penult if this were long or on the antepenult if the penult were short. Words with four or more syllables had a secondary accent on the first syllable : e.g. *tèmpestā́tem*.

25. *Armenian Accentuation.*

In Classical Armenian, the accent fell on what had originally been the penultimate syllable. That the accent was one of stress is shown by the widespread reduction and elimination of unaccented syllables.

26. *Summary/Indo-European.*

The Old Indic system of accentuation remained the most faithful to that of Late Indo-European. The accent limitation rule found in Greek is clearly an innovation. Likewise, the development of the circumflex probably arose, at least in part, as the result of contractions in the early prehistory of

Greek itself (cf. KURYŁOWICZ 1958:106f.). Baltic and Slavic have innovated even more than Greek. Unlike Late Indo-European and Old Indic, which had register-type systems, Baltic and Slavic had contour-type systems. Moreover, the position of the accent has undergone a systematic displacement. The accentuation of Late Indo-European and Old Indic was syllable oriented, while that of Greek, Baltic, and Slavic was mora oriented. None of the remaining daughter languages supply any information either about the distribution or about the quality of the accent in the parent language except for Germanic, which supplies some information about the original position of the accent.

The system of accentuation of Late Indo-European was characterized by contrasts in pitch, two types of which were distinguished : high pitch and low pitch. Stress was nondistinctive. Every word, except when used enclitically, bore an accent ; however, each word had only one accented syllable. The accented syllable had high pitch, and all other syllables had low pitch.

The accent could fall on any syllable, initial, medial, or final. The position of the accent was morphologically-conditioned, accentuation being one of the means by which Indo-European distinguished grammatical categories. Though originally not restricted to a particular syllable, there was a tendency to level out the paradigm and fix the position of the accent throughout. This tendency, the development of columnar accentuation, began in Late Indo-European and continued through Disintegrating Indo-European into the daughter languages. Therefore, the earlier system is only imperfectly preserved in even the most conservative of the daughter languages, Vedic Sanskrit.

There is internal evidence that at one time stress was the dominant characteristic of the Indo-European system of accentuation. The quantitative vowel gradation, of which all of the older daughter languages preserve traces, must have come into being as the result of a strong stress accent. However, in the latest period of development, stress had ceased to have any effect on vowel quantity in the parent language.

27. *Meter.*

Comparison of Sanskrit and Greek indicates that poetic rhythm in Disintegrating Indo-European was quantitative, being based upon the regular repetition of long and short syllables. Though the original patterning has sometimes been obscured, the rule is clear that open syllables ending in a short vowel were metrically short, while open syllables ending in a long vowel and closed syllables were metrically long. Cf. LEHMANN 1952:§ 2.4.

28. *Concluding Remarks.*

In the preceding survey, the development of the revised Indo-European phonological system was traced into the daughter languages. Even though only the major changes were discussed, enough was given to show that the new system can account for developments in the daughter languages at least as well as the traditional system. In several cases, the new system was even able to provide answers where the traditional system only left questions. In this section, we will look at one or two other points as well as some areas for future study.

Languages having ejectives also have a glottal stop almost without exception (for examples, cf. the phonological systems given in RUHLEN 1976). Since a glottal stop thus seems to be implied typologically, we can now confirm that SAPIR and STURTEVANT were correct in their interpretation of KURYŁOWICZ's first laryngeal as a glottal stop (cf. STURTEVANT 1942:§ 8b and 1951:§ 77). I propose that the Indo-European phonological system remained stable as long as it had a glottal stop and that it was the loss of the glottal stop in Disintegrating Indo-European (cf. § 3; BOMHARD 1975:§ 6.4) that precipitated the elimination of the glottalics.

We saw in § 6 that the phoneme traditionally reconstructed as *b* was probably nonexistent in Indo-European. Under the revised interpretation, this sound would have been a labial ejective. Had this sound existed in the Indo-European parent language, it would have developed into *b* in those daughter languages that have changed the ejectives into voiced stops. In the case of Skt. *píbati* " drinks ", Lat. *bibit*, and OIr. *ibid*, we have direct evidence for such a development. While it is common for languages having ejectives to lack the labial member (cf. GREENBERG 1970:127), it is not common for languages with a voiced ~ voiceless contrast to lack the voiced labial (cf. BIRNBAUM 1975:13f.; GAMKRELIDZE 1976:401). Since the normal development of the Disintegrating Indo-European phonological system in Greek, Italic, and Indo-Aryan would have created such a gap, a voiced labial was introduced in these languages by various means. In Greek, the glottalized labiovelar developed into *b* (written β) under certain conditions. This is the regular development in Oscan and Umbrian. In Latin, *b* arose from medial *f* and from earlier *θ* when before or after *r*, before *l*, or after *u*. In Indo-Aryan, *b* arose from *bh* through the change described by GRASSMANN's Law. Furthermore, the gap was also filled through borrowings.

There have been several attempts to join Indo-European with other language families in some sort of genetic relationship. In spite of some progress, truly convincing evidence that Indo-European was related to one or more other language families has simply not been brought forth, however. As long as we operated with the traditional phonological system, Indo-European was doomed to remain isolated genetically since it was isolated typologically. Now that the phonological system has been revised to bring it into harmony with natural systems, the question of possible genetic relationship can be looked at in fresh perspective.

It is now fairly certain that the Indo-Europeans were the bearers of the Kurgan culture and that their homeland was located in the area to the north of and between the Black and Caspian Seas (cf. BIRNBAUM 1974:361f. ; GIMBUTAS 1970:155f.). To the immediate north, Uralic languages were spoken (cf. HAJDU 1975:30f.), while Caucasian languages were spoken immediately to the south. Farther to the south, Afro-Asiatic languages were found, while Elamo-Dravidian languages covered all of Iran and northern India (on the question of the relationship of Elamite to Dravidian, cf. MCALPIN 1974:89f.). It is among these languages that we should be looking for possible evidence of earlier relationship with Indo-European. It should be noted that GAMKRELIDZE (1967:707f.) has already pointed out parallels in vowel gradation patterning and root structure between Indo-European and Kartvelian (cf. also ANTTILA 1969:177f.). At the Conference on Indo-European and Typological Studies, held in conjunction with the 1976 Summer Meeting of the Linguistic Society of America, I presented a paper entitled " The ' Indo-Semitic ' Hypothesis Re-examined " (now published in *Journal of Indo-European Studies*, vol. 5, 1977), in which I argued in favor of the possibility of genetic relationship between Indo-European and Semitic. A considerably revised version of this paper will appear in the Kerns Gedenkschrift volume.

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